

ON METHODS FOR THE ANALYSIS OF LARGE FE SYSTEMS SUBJECTED TO STOCHASTIC DYNAMIC EXCITATION

G.I. Schuëller

Institute of Engineering Mechanics
Leopold-Franzens University,
Technikerstrasse 13
A-6020 Innsbruck, Austria, EU
g.i.schueller@uibk.ac.at

For a long time efforts to analyse systems under Stochastic dynamic excitation concentrated mainly on the analytical treatment of SDOF, or at the most 2 DOF systems. It was in the eightieth and early ninetieth of the last century when computational procedures opened the way to analysing structures of larger size, but yet still considered to be small when compared to structural systems as analysed deterministically (see e.g. [1]). Although e.g. perturbation procedures proved to be very effective, they are still limited to small non-linearities. Equivalent linearization procedures, however, are capable of treating larger non-linearities and also structures of larger sizes, but yet provide estimates of second moments only. So far only so called weight controlled simulation procedures allowed the calculation of reliability estimates of such structures, i.e. within an acceptable computational efforts.

Just recently, the analyses were extended to larger FE Systems (e.g. about 100000 DOF) with non-linearities by using the so called Karhunen-Loève expansion which allowed the reduction of the dimension of the problem. The non-linearities are treated by local EQL-procedures. Yet, only 2nd moment characteristics can be obtained by these methods.

In this paper an overview on all currently available procedures to analyse large FE systems will be given. The comparison between the methods refer to their range of validity (w.r.t. non-linearities), capability of treating a particular dimensionality, required computational efforts, types of computational procedures used, type of results, e.g. 2nd moments or reliability estimates, etc.

References

[1] G.I. Schuëller, H.J. Pradlwarter, M. Vasta, and N. Harnpornchai. Benchmark-study on non-linear stochastic structural dynamics. In N. Shiraishi, M Shinozuka, and Y.K. Wen, editors, Proceedings of the 7th International Conference on Structural Safety and Reliability (ICOSSAR'97), pages 355 -361. A.A. Balkema Publications, Rotterdam, The Netherlands, November 1998.